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Traumatic Injury to the Inferior Vena Cava —Report of a Case—

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Abstract

A case is presented of a 27-year-old male who had fallen from a 2-meter scaffold onto an iron rod, sustaining a fracture of the 4th vertebra, a free bone fragment of which lacerated and protruded into the inferior vena cava. The injury was limited to the retroperitoneal region, and the retroperitoneal hematomas effectively tamponaded the injury. A diagnosis of injury to the inferior vena cava was made preoperatively from plain abdominal roentgenogram, CT scan, and clinical findings of retroperitonitis and anemia. The injured vessel was sutured from the inside and reconstructed using a Goretex patch.

Introduction

Fractures and dislocations, especially in the extremities, frequently cause vascular injury. We encountered a rare case in which a free bone fragment of the fractured vertebra injured the inferior vena cava. We present the details of this case.

Report of a Case

A 27-year-old male, fell from a 2-meter scaffold onto an iron rod of the type used for reinforcing concrete. The rod penetrated 10 cm into the median lumbar back (1 cm below the Jacoby's line). He was immediately taken to our hospital. No motor or sensory disturbance was noted on admission. The blood pressure was 130-70mmHg, pulse 66/min regular, and body temperature 35.9°C. He had suffered from right femoral fracture and acute hepatitis at the age of 3 and 14 years, respectively.

Laboratory findings are shown in Table 1. Slight anemia, high serum levels of C-reactive protein, creatine phosphokinase and total bilirubin as well as glycosuria were found.

Bone roentgenogram revealed a fracture in the portion of the body and lamina of the 4th lumbar vertebra; the right posterior oblique view revealed a free bone fragment anterior the 4th vertebra

Key words: Inferior vena caval injury, Vertebral fracture, Pulmonary embolism.
索引語：下大静脈損傷，椎骨骨折，肺塞栓症.
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Table 1. Laboratory findings

WBC 10300/mm³	RBC 348×10⁴/mm³	Hb 10.2 g/dl	Hct 31.4%
Na 139 mEq/l	K 3.3 mEq/l	Cl 100 mEq/l	TP 5.9 g/dl
BUN 10 mg/dl	BS 207 mg/dl	T-bil 1.5 mg/dl	D-bil 0.6 mg/dl
GOT 15 u	GPT 12 u	LDH 288 u	CPK 103 u
RAT (++)	ASLO 240 Todd u	CRP (+++)	
Urine: Glu (+++)	Pro (−)	occult Blood (−)	

(Fig. 1A and 1B). Moreover, the right edge of the major psoas muscle, clearly visualized on admission, could not be seen the following morning. CT scan revealed a fracture of the 4th lumbar vertebra and a fragment that appeared to be located adjacent to or in contact with the inferior vena cava, the contour of which was not clear (Fig. 2). These findings strongly suggested retroperitoneal bleeding around the inferior vena cava. A gas picture of the small intestine was also noted on the plain roentgenogram the following morning.

Based of these clinical findings, the patient was diagnosed as having retroperitoneal bleeding around the inferior vena cava that resulted from the laceration of the vessel by the free spicle of the 4th lumbar vertebra.

An abdominal median incision revealed absence of blood in the abdominal cavity and the inferior vena cava, around which coagula was accumulated, and tamponaded the

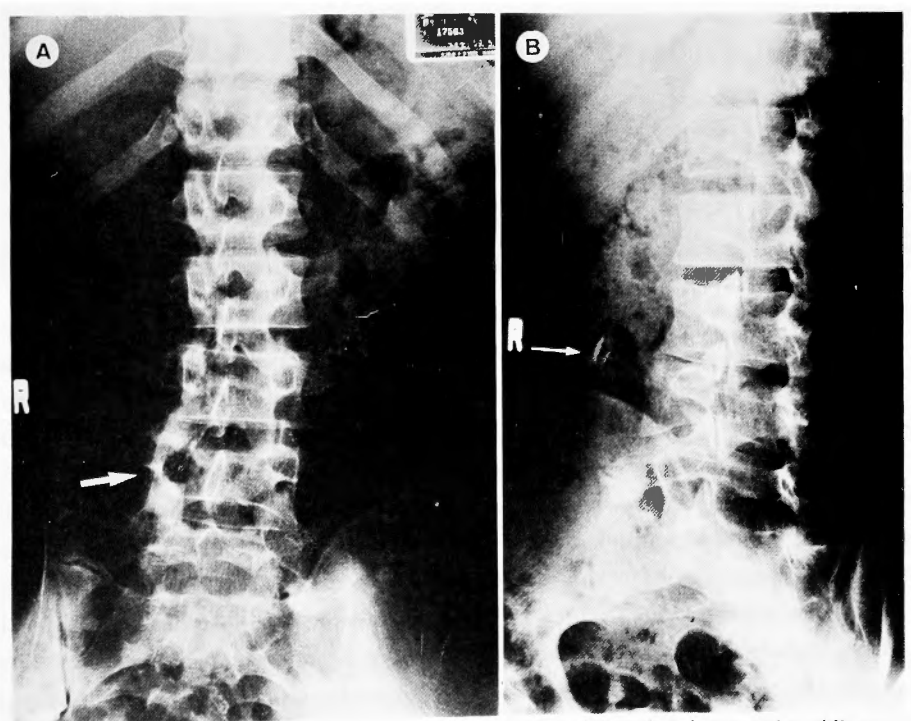

Fig. 1. Plain roentgenograms in anteroposterior view (A) and right posterior oblique view (B)
Arrows in A and B show fracture of the 4th vertebra and a free bone fragment, respectively.

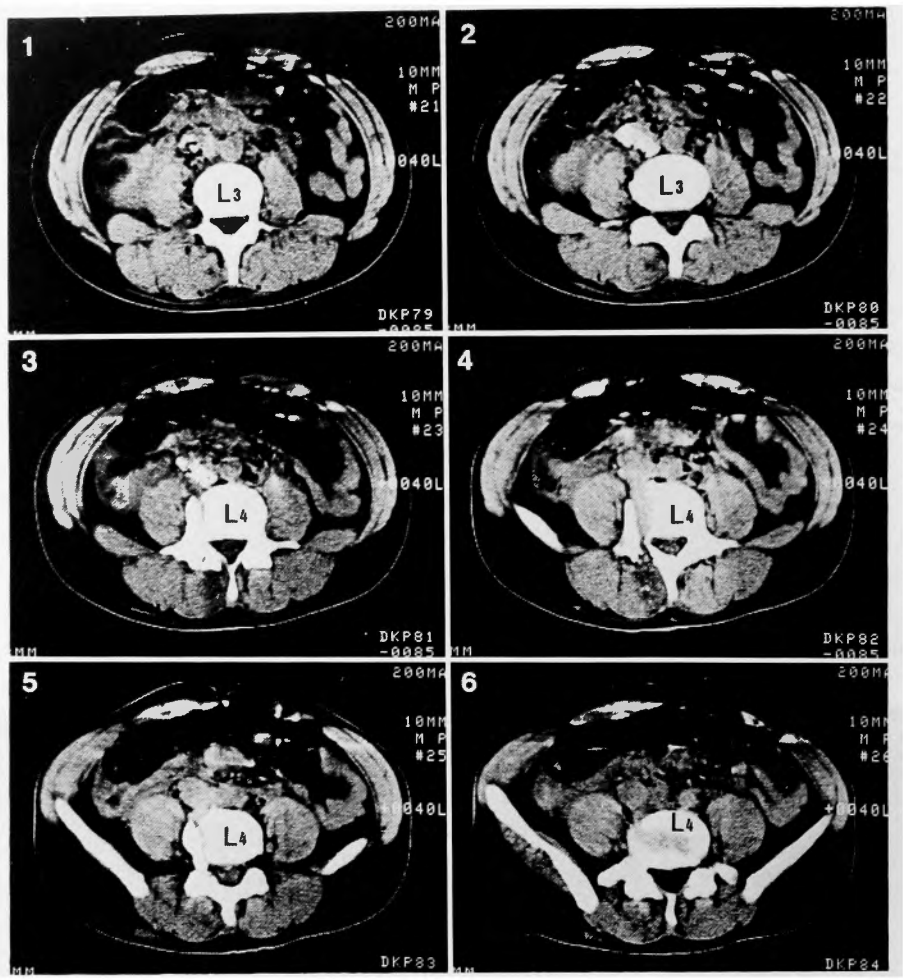

Fig. 2. Serial scanning (slice width 10 mm, slice level between L3 and L4).

injury. Behind the inferior vena cava a free bone fragment was present, anteriorly compressing the vessel. After the vessel was clamped, an anterior longitudinal incision revealed a sharp bone spicle protruding into the inferior vena cava (Fig. 3). The bone fragment was removed and the laceration was sutured from the inside. Direct suturing of the incision was not applicable due to the subsequent development of elevated venous pressure and the dilatation of the distal inferior vena cava. Thus, the vessel was enlarged using a Goretex patch (15×45 mm in size). During the operation obstruction of the left common iliac vein was noted. Adhesion to the circumference of the vessel, but no thrombus, suggested an old traumatic inflammation, maybe due to the right femoral fracture at the age of 3 years.

The postoperative course was uneventful. Angiography was performed 47 days after the operation. The injured portion of the inferior vena cava was slightly stenotic, without a pressure gradient (Fig. 4A). Examination of the obstruction of the left common iliac vein disclosed sufficient collateral blood flow passing through the ascending lumbar vein and internal iliac vein (Fig. 4B).

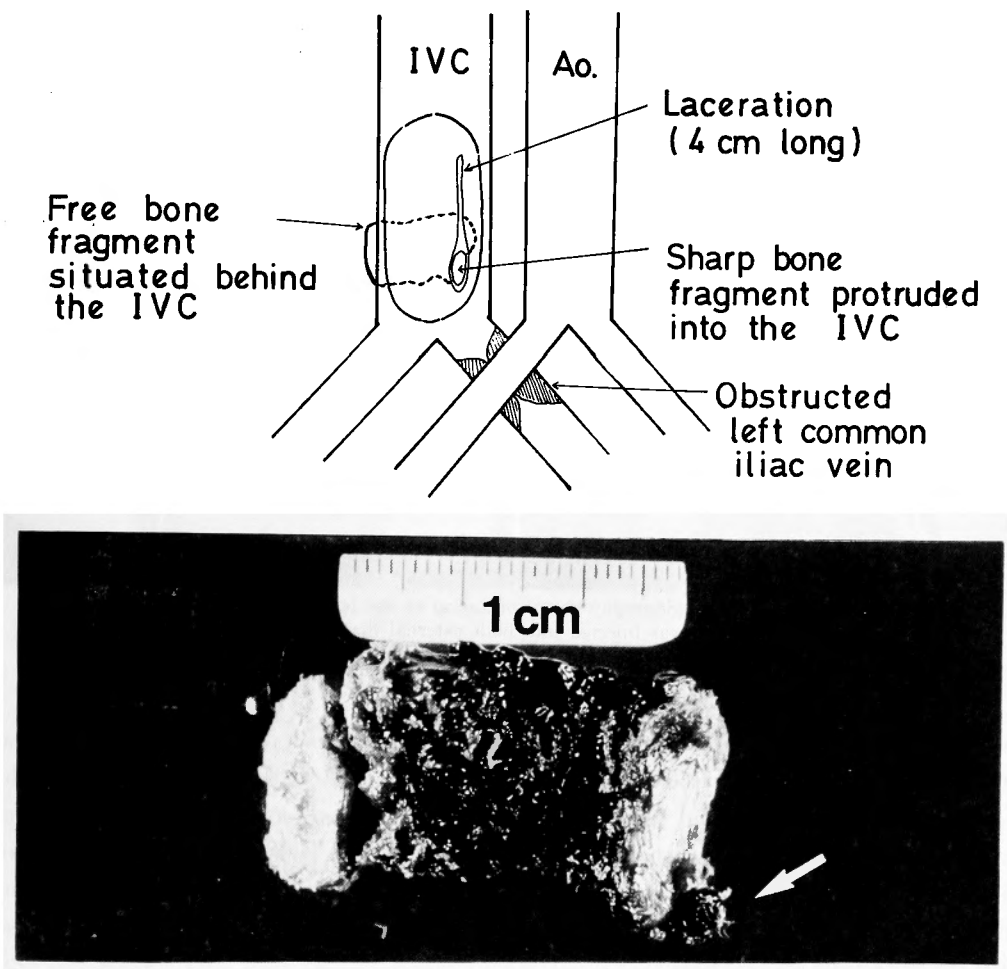

Fig. 3. Schematic operative findings and the resected bone fragment
Arrow shows the portion of the free bone fragment protruding into the inferior vena cava.

Discussion

Inferior vena caval injuries are associated with a high mortality. Thirty-six per cent of those with inferior vena caval injuries die before reaching to the hospital[6] while 34 to 57 per cent of those who reach the hospital also die[1,2,3,6,7,8,9]. The vena cava is protected from behind by the vertebral column; consequently, most injuries to it result from anterior or lateral approach[6]. Regardless of the type of wound, injuries to the inferior vena cava are commonly associated with damage to other abdominal organs and vessels. WEICHERT[9] reported that the average number of organs injured in addition to the vena cava was 2.5. Therefore, a major problem in management of these injuries is control of hemorrhage, especially massive bleeding due to upper abdominal vascular traumas[2,4,5].

Fortunately, massive bleeding did not occur in our case, because the injury was limited to the

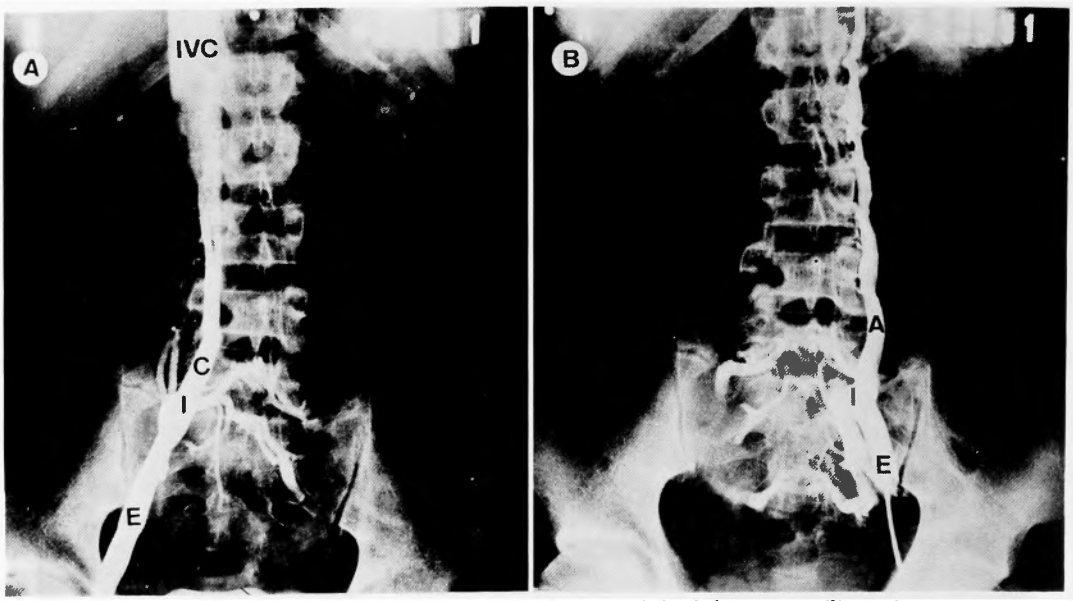

Fig. 4. Postoperative angiography shows occlusion of the left common iliac vein. Contrast media was injected into both external iliac veins.
IVC: inferior vena cava, E: external iliac vein, I: internal iliac vein, C: common iliac vein, A: ascending lumbar vein.

retroperitoneal space; in addition, the unhurt retroperitoneum and retroperitoneal hematomas effectively tamponaded the vascular injury despite the laceration of the inferior vena cava by a free bone fragment following vertebral fracture. Another expected late complication was pulmonary embolism caused by thrombi developing around the bone fragment that protruded into the inferior vena cava. Despite controllable hemorrhage, reconstruction of the inferior vena cava was necessary to avoid pulmonary embolism. When spinal cord injuries are present, neurologic and orthopedic management are needed, in such case the prognosis is poor.

Injuries to the inferior vena cava following vertebral fracture are rare. In our case, diagnosis of injuries to the vessel was made upon plain abdominal roentgenogram, CT scan, and clinical findings of retroperitonitis and anemia. In the management of patients sustaining a stab wound in the back, it is necessary to consider the possibility of vertebral fracture and subsequent injuries to the vessels and organs in the retroperitoneal space and/or abdominal cavity.

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和文抄録

外傷性下大静脈損傷の一治験例

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27歳，男性，2 m の足場を踏みはずし落下，13 mm 径の鉄棒が腰背部に 10 cm 刺入した．この外傷で，第4腰椎の骨折を来たし，その遊離骨片は下大静脈を損傷し，内腔に突出したままで留まった．術前の腹部単純レ線，CT scan，および後腹膜炎・貧血の臨床所見から下大静脈損傷と診断し手術を行なった．下大静脈の前面に切開を加え内腔より損傷部分を縫合，狭小を来たしたため切開部分に Goretex patch をあてて拡大した．本例では，放置すれば肺塞栓症続発の可能性が考えられた．